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Year: 2023

Version: Published version

Please cite the original version:

Wang, M., Raza, A., Narusyte, J., Silventoinen, K., Böckerman, P., Svedberg, P., & Ropponen, A. (2023). Family-Related Life Events as Predictors of Labor Market Marginalization Trajectories : A Cohort Study of Swedish Twins. Journal of Occupational and Environmental Medicine, 65(8), 627-634. https://doi.org/10.1097/JOM.0000000000002869

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Family-Related Life Events as Predictors of Labor Market Marginalization Trajectories

A Cohort Study of Swedish Twins

Mo Wang, PhD, Auriba Raza, PhD, Jurgita Narusyte, PhD, Karri Silventoinen, PhD, Petri Böckerman, PhD, Pia Svedberg, PhD, and Annina Ropponen, PhD

Objectives: The aims of the study are to investigate trajectories of labor market marginalization (LMM) and to examine the associations between family-related life events and LMM trajectories while accounting for familial factors. **Methods:** This is a prospective cohort study of 37,867 Swedish twins. Data were analyzed by group-based trajectory modeling. Associations of family-related life events with trajectory groups were estimated by multinomial logistic regression. **Results:** Most participants had no or low levels of LMM. Individuals who stayed married over time or changed from single without children to married with children had a decreased risk of LMM. The risk of LMM over time was higher among individuals who changed from married to being single. **Conclusions:** Being or getting married as well as having children decreases the risk of LMM while divorce is a risk factor for LMM.

Keywords: sick leave, disability pension, unemployment, life event, twin study

CME Learning Objectives

After completing this enduring educational activity, the learner will be better able to:

- Discuss trajectories of labour market marginalization
- Describe the effects of stability and change in family life on LMM trajectories
- Outline the importance of family related life events for LMM

Labor market marginalization (LMM) can be characterized by unemployment, sickness absence (SA), and disability pension (DP).[1] In many European countries, reducing the extent of LMM is a central policy concern.[2,3] Sickness absence and DP are also major public health concerns and an economic challenge for individuals, employers, and the welfare state.[4] Being on SA, particularly long-term SA, tends to marginalize employees from the labor market and lead to permanent exclusion (eg, DP) from the workforce.[5–7] Moreover, disability pensioners and unemployed individuals often report negative consequences on health, economy, social integration, and face premature mortality.[8,9] In addition, conceptualization of LMM including measures of both unemployment and SA/DP, which are based on medical assessments, is recommended.[1]

The magnitude of LMM in European countries requires more knowledge about the predictors for unemployment and SA/DP to initiate effective interventions.[4] Several studies have previously reported associations between demographic, socioeconomic, health- and work-related factors, and future unemployment and SA/DP.[10–13] However, much fewer studies have considered long-term risks of LMM trajectories. The course of LMM can be heterogeneous in the population because among some individuals the level of LMM can be reduced while some individuals may remain high in LMM risk over time. Hence, understanding the heterogeneity and trajectories of LMM over time is of crucial importance and might also facilitate individualized rehabilitation measures that improve attachment to the labor market.

Family-related life events, such as marriage, having children or divorce, play an important role in health and interplay with human lives from birth to death.[14–16] Any change in family life, such as getting married, giving birth, or losing a spouse, that restructure family configurations may have extensive effects on mental and physical health of the individual undergoing the changes.[17] For instance, previous studies have reported that those who make a transition from being married to divorce have a poorer health than those who have been continuously married, while some studies suggest that socioeconomic factors, such as educational level, has play a role in the association.[15,17] A study on single parents also found significantly higher rates of psychological distress among those who separate compared with married parents.[18] Negative family events, for example, divorce and suboptimal health conditions, are expected to be associated with future adverse labor market outcomes.[19,20] Because family life would not remain stably over time, for example, people can get married, have children, or get divorce, these changes may affect economic outcomes and other living conditions. Therefore, a measure of history of family-related life events by accounting both transitions of marital status and changes in situations of having children is important for understanding the development of adverse outcomes over the life course.

Although findings from previous studies suggest that family-related life events are associated with poor health, studies investigating

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Funding sources: This study was funded by Forte (2019-01284). The Swedish Twin project of Disability pension and Sickness absence (STODS) receives funding through the Swedish Research Council under the grant number 2017-00624. The Swedish Twin Registry is managed by Karolinska Institutet and receives funding through the Swedish Research Council under the grant number 2017-00641.

Wang, Raza, Narusyte, Silventoinen, Böckerman, Svedberg, and Ropponen have no relationships/conditions/circumstances that present potential conflict of interest.

The JOEM editorial board and planners have no financial interest related to this research.

Ethical Considerations and Disclosures: This study was approved by the Regional Ethical Review Board in Stockholm, Sweden. The data that support the findings of this study are available from the original sources: the Swedish Twin Registry, Statistics Sweden, Swedish Social Insurance Agency, and the Swedish National Board of Health and Welfare. Restrictions apply to the availability of the data used in this study based on the Swedish Twin project of Disability pension and Sickness absence (STODS), which were used with ethical permission for the current study and therefore are not publicly available.

Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).

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DOI: 10.1097/JOM.0000000000002869

family-related life events in association with labor market outcomes, such as unemployment and SA/DP, are limited. In most European countries, women with children in the household typically have a part-time job,[21] and the involvement in employment and concurrently having children are considered as two of the reasons for high levels of SA, particularly for single mothers.[22–24] On the other hand, some studies have demonstrated that the multiple roles have a positive influence on health and well-being.[25] Moreover, studies from the Nordic countries have shown that not giving birth is a risk factor for SA and DP compared with women giving birth.[26,27] Somatic and mental morbidity both before and after childbirth showed a strong association with SA and DP.[27] However, previous studies have mainly focused on single family-related life event and knowledge on the effects of stability and change of family life (eg, transition from unmarried to married, from marriage to divorce, or from not having to having children, etc) on LMM trajectories is particularly limited.

Moreover, an earlier study based on the Finnish twin cohort indicated the role of familial confounding (ie, genetics and shared environment, mainly in childhood) on the associations between family-related life events (ie, having a child, marrying/divorce) and DP due to musculoskeletal diagnoses.[28] The number of family-related life events at one time point predicted increased risk of DP, whereas the absence of family-related life events decreased the risk. The assumption was that familial factors might play a role in the tendency of having many family-related life events or that genetics influence both the risk of DP due to musculoskeletal diagnoses and the frequency of life events.[29] By using a twin design, unmeasured confounders can be adjusted for, because cotwins are matched on genetic (100% for

TABLE 1. Descriptive Statistics of the Study Population of 37,867 Twins

	Whole Sample		Discordant Twin Pairs				
	(*N* = 37,867)		Twins With Stable Family Life (*n* = 4,647)		Twins With Changed Family Life (*n* = 4,647)		
Variables	***n***	**%**	***n***	**%**	***n***	**%**	χ^2
Sex							***P* < 0.05**
Male	19,079	50.4	2,367	51.0	2,129	45.8	
Female	18,788	49.6	2,280	49.1	2,518	54.2	
Age, yr							*P* = 1.00
20–24	8,562	22.6	526	11.3	526	11.3	
25–29	9,574	25.3	1,473	31.7	1,473	31.7	
30–34	8,715	23.0	1,396	30.0	1,396	30.0	
35–40	11,016	29.1	1,252	26.9	1,252	26.9	
Zygosity							*P* = 1.00
Monozygotic	8,547	22.6	972	20.9	972	20.9	
Dizygotic same sex	10,090	26.7	1,323	28.5	1,323	28.5	
Dizygotic opposite sex	12,857	34.0	676	14.6	676	14.6	
Unknown zygosity	6,373	16.8	1,676	3.1	1,676	3.1	
Education, yr							*P* = 0.50
<10	5,858	15.5	776	16.7	777	16.7	
10–12	21,760	57.5	2,635	56.7	2,689	57.9	
>12	9,099	24.0	1,096	23.6	1,176	25.3	
Unknown/missing	1,150	3.0	140	3.0	5	0.1	
Area of residence[a]							*P* = 0.16
Big cities	12,718	33.6	1,598	34.4	1,607	34.6	
Medium-sized cities	13,318	35.2	1,542	33.2	1,668	35.9	
Small cities/villages	10,843	28.6	1,391	29.9	1,372	29.5	
Unknown/missing	988	2.6	116	2.5	0	0.0	
History of inpatient care							
Mental diagnosis	1,030	2.7	147	3.2	117	2.5	*P* = 0.06
Somatic diagnosis	14,535	38.4	1,829	39.4	2,665	57.5	***P* < 0.05**
Family-related life events (1990–1993)							***P* < 0.05**
Stable family life	31,544	83.3	4,647	100.0	—	—	
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	693	1.9	—	—	511	11.0	
From married[b] without children to single[c] with/without children	97	0.3	—	—	68	1.5	
From married[b] with children to single[c] without children	469	1.2	—	—	375	8.1	
From married[b] with children to single[c] with children	653	1.7	—	—	502	10.8	
From single[c] without children to married[b] without children	713	1.9	—	—	507	10.9	
From single[c] without children to married[b] with children	3,023	8.0	—	—	2,177	46.9	
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	393	1.0	—	—	300	6.5	
From single[c] with children to married[b] with/without children	282	0.7	—	—	207	4.5	
Outcomes (1994–2016)							
Unemployment	1,352	3.6	190	4.1	168	3.6	*P* = 0.24
Sickness absence	4,382	11.6	622	13.4	621	13.4	*P* = 0.98
Disability pension	3,037	8.0	424	9.1	363	7.8	***P* = 0.02**
Labor market marginalization	8,117	21.4	1,137	24.5	1,066	22.9	*P* = 0.08

Significant results are marked in bold.

[a]Area of residence: big cities: Stockholm, Göteborg, and Malmö; medium-sized cities: cities with more than 90,000 inhabitants within 30-km distance from the center of the city; small cities/villages.

[b]Married includes living with partner; cohabitant.

[c]Single includes divorced, separated, or widowed.

monozygotic [MZ] and on average 50% for dizygotic [DZ] twin pairs) and common rearing environmental variation (100% for both MZ and DZ twins). An exposure is evaluated after adjustment for familial factors with a cotwin control design (matched case-control analysis). This is commonly compared with results of an analysis of the whole sample, where the twins are considered as individuals to examine the impact of familial factors.[30,31] In addition, twin studies have reported that familial factors, that is, genetic factors and family environment, account for 36% to 50% of the variance in SA and DP and approximately 27% for life events.[32–34] Therefore, it is important to account for the possible influence of familial confounding, which can optimally be accomplished by using the twin design.

AIMS

The first aim of the study was to examine LMM trajectories (as indicated by unemployment, SA and DP, separately and combined) during 1994–2016. The second aim was to investigate the effects of stability and change in family life during 1990–1993 (based on having children and/or marrying/divorcing) on LMM trajectories. Family-related life events in discordant twin pairs were specifically investigated for their LMM trajectories to account for the effects of familial factors.

METHOD

Data and Sample

This prospective study was based on data from the Swedish Twin project of Disability pension and Sickness absence (STODS) study, which comprises data from several sources. From the Swedish Twin Registry, there is a total of 119,907 twin individuals born between 1925 and 1990, which consists of nearly all the twins born in Sweden during these years.[35] Data on life events, unemployment, and sociodemographic variables were obtained from the Longitudinal Integration Database for Health Insurance and Labour Market Studies, Statistics Sweden.[36] Information on SA and DP was gathered from the MicroData for Analyses of Social insurance register from the Swedish Social Insurance Agency. Data on the history of diagnosed diseases were collected from the Swedish National Patient Register (date and diagnosis for inpatient care) from the National Board of Health and Welfare.[37] The data were linked by using unique personal identification number provided to all Swedish residents.

The study population comprised all Swedish twins aged between 20 and 40 years and living in Sweden on December 31, 1993 (N = 37,867). Among them, 18,378 were complete twin pairs whereas 10,090 were same-sex DZ twins, 12,857 opposite-sex DZ twins, 8547 MZ twins, and 6373 were of unknown zygosity. There were 4647 twin pairs discordant for family-related life events, that is, one twin in a pair had stable family life and the other twin had changed family life during 1990–1993.

Exposure

The exposure measure included family-related life events, which was based on having a child and/or marrying/divorcing during 1990–1993. The life events were classified into categories shown in Supplementary Table 1, http://links.lww.com/JOM/B331. Individuals with stable family life had the same family status, whereas those with changed family life changed their family status during 1990–1993. Some categories of family-related life events included only few individuals and were merged (Table 1).

Outcomes

Labor market marginalization was measured by (1) sum of net months with unemployment per year (calculated from annual days) during 1994–2016, (2) sum of net months with SA (>14 days) and DP per year (calculated from annual net days) during 1994–2016, and (3) combined LMM, measured as the sum of annual months with unemployment, SA, and DP. Part-time SA/DP was converted to full-time, that is, 2 days on half-time SA/DP equaled 1 day of full-time SA/DP.

Sickness absence benefits are generally granted by the Social Insurance Agency to all individuals in Sweden from the age of 16 years who have an income from work or unemployment benefits and who have a reduced work capacity due to a disease or injury.[38] Individuals with a permanently impaired work capacity due to a disease or injury are eligible for DP benefits. Employers pay sick pay during the first 14 days. There is one qualifying day (more for self-employed) without benefits. A physician's certificate is required after 7 days of self-certification. Sickness absence amounts to 80% of lost income while DP to approximately 65%. Entitlement to unemployment benefits presumes

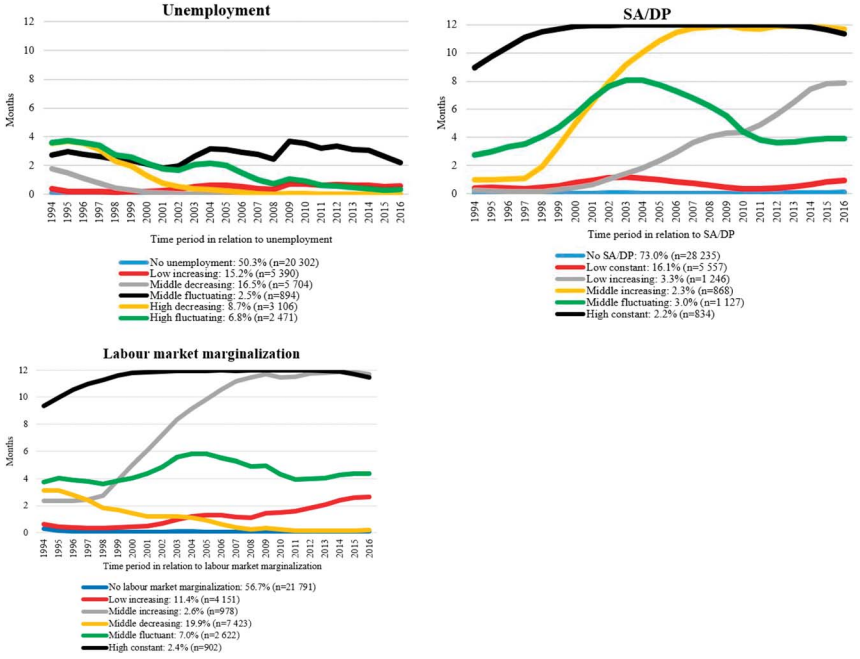

FIGURE 1. Trajectory groups of unemployment, SA and DP, and LMM (ie, combined measure of unemployment, SA, and DP) months and percentages of twins (N = 37,867) within each trajectory group during 1994 and 2016.

a defined minimum income from work. To receive compensation from an unemployment insurance fund, individuals must be registered as unemployed at the Swedish Public Employment Service. They should be able and willing to take a job right away.

Covariates

Covariates regarding sociodemographic factors were measured on December 31, 1993, and consisted of age, sex, years of education, and area of residence. A history of mental and somatic morbidity before 1994 from inpatient care was also used as a covariate (Table 1).

Statistical Analysis

Statistical differences in the distributions of variables in relation to covariates, exposure, and outcome were assessed with χ^2 tests. P values less than 0.05 indicate a significant difference. Group-based trajectory models were used to identify trajectory groups of LMM in 1994–2016 among the whole sample. This procedure is based on a mixture model that provides the capacity to identify subgroups of individuals who followed distinct trajectories during the time of observation and estimates a regression model for each discrete group.[39] In addition, this method could provide the possibility to assess variation and stability over time for each identified subgroup and the proportion of individuals in each group. The best fitting model in relation to the number of groups was tested by using Bayesian information criterion, Akaike information criterion, and average posterior probability. In this study, we applied a priori requirement of a minimum of 2% of the study population for the smallest group. By applying these criteria, six groups were selected as the best fitting model for the outcomes. Detailed

TABLE 2. Odds Ratios With 95% CIs for Changed Family Life Compared With Stable Family Life in Relation to Unemployment Trajectory Groups Among Whole Sample and Within Discordant Twin Pairs

	Whole Sample[a]				
	Low increasing (n = 5,390)	Middle decreasing (n = 5,704)	Middle fluctuant (n = 894)	High decreasing (n = 3,106)	High fluctuant (n = 2,471)
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.65 (0.50–0.83)**	**0.71 (0.55–0.91)**	0.62 (0.33–1.17)	**0.67 (0.48–0.95)**	0.65 (0.44–0.96)
From married[b] without children to single[c] with/without children	**1.86 (1.08–3.23)**	**2.04 (1.17–3.55)**	**4.44 (1.96–10.09)**	1.26 (0.53–3.00)	1.30 (0.51–3.35)
From married[b] with children to single[c] without children	**1.38 (1.06–1.78)**	1.13 (0.84–1.54)	1.44 (0.86–2.42)	**1.58 (1.13–2.19)**	**2.03 (1.48–2.78)**
From married[b] with children to single[c] with children	**1.31 (1.04–1.65)**	**1.36 (1.07–1.72)**	**2.11 (1.39–3.21)**	**1.79 (1.38–2.33)**	**1.85 (1.40–2.45)**
From single[c] without children to married[b] without children	0.96 (0.77–1.19)	0.93 (0.75–1.16)	0.62 (0.33–1.16)	0.75 (0.54–1.04)	**0.59 (0.39–0.88)**
From single[c] without children to married[b] with children	**0.85 (0.75–0.95)**	**0.88 (0.78–0.98)**	**0.72 (0.54–0.95)**	0.93 (0.81–1.07)	**0.83 (0.71–0.97)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	1.32 (0.98–1.79)	1.12 (0.81–1.55)	1.78 (0.98–3.25)	**2.15 (1.56–2.95)**	**2.46 (1.77–3.42)**
From single[c] with children to married[b] with/without children	0.86 (0.58–1.28)	**1.61 (1.15–2.24)**	**2.17 (1.18–3.99)**	**1.81 (1.23–2.67)**	1.39 (0.88–2.20)
	Discordant twin pairs				
	Low increasing (n = 1,338)	Middle decreasing (n = 1,318)	Middle fluctuant (n = 238)	High decreasing (n = 768)	High fluctuant (n = 641)
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.60 (0.44–0.82)**	0.80 (0.60–1.07)	0.66 (0.30–1.44)	0.73 (0.48–1.09)	0.68 (0.43–1.08)
From married[b] without children to single[c] with/without children	1.68 (0.87–3.24)	1.69 (0.86–3.34)	**3.38 (1.14–10.09)**	1.47 (0.56–3.85)	1.05 (0.31–3.51)
From married[b] with children to single[c] without children	1.30 (0.96–1.76)	1.03 (0.73–1.47)	1.49 (0.84–2.66)	**1.54 (1.04–2.27)**	**1.97 (1.34–2.88)**
From married[b] with children to single[c] with children	1.24 (0.94–1.63)	1.23 (0.92–1.64)	**2.29 (1.38–3.81)**	**1.55 (1.12–2.15)**	1.25 (0.86–1.79)
From single[c] without children to married[b] without children	0.94 (0.71–1.23)	0.95 (0.73–1.25)	0.65 (0.31–1.35)	0.69 (0.46–1.04)	**0.43 (0.35–0.74)**
From single[c] without children to married[b] with children	**0.82 (0.70–0.96)**	**0.81 (0.69–0.95)**	0.74 (0.52–1.05)	0.96 (0.79–1.17)	**0.79 (0.63–0.99)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	1.18 (0.82–1.69)	1.05 (0.72–1.54)	1.12 (0.47–2.65)	**2.19 (1.51–3.18)**	**2.12 (1.43–3.14)**
From single[c] with children to married[b] with/without children	0.81 (0.50–1.29)	1.43 (0.96–2.14)	1.82 (0.80–4.15)	1.51 (0.93–2.45)	1.20 (0.70–2.06)

Significant results are marked in bold.

[a]Sex, age, education, area of residence, and history of mental and somatic diagnosis at baseline were adjusted in the model with the whole sample.

[b]Married includes living with partner; cohabitant.

[c]Single includes divorced, separated, or widowed.

information on goodness of fit statistics is reported in Supplementary Table 2, http://links.lww.com/JOM/B331. Year 1994 was defined as the starting time point and the patterns of mean number of months with unemployment or net months with SA/DP were measured annually from 1994 up to 2016.

Moreover, we used the multinomial logistic regression model for elucidating the associations of family-related life events with the identified LMM trajectory groups by controlling for the covariates. The analysis was conducted for the whole sample and conditional models were performed for discordant twin pairs (ie, one twin in a pair had change in family life in 1990–1993 and the other did not) to examine the influence from familial factors. If the associations from the whole sample attenuated or changed direction in the discordant twin pair analyses, this would suggest the impact from familial factors, that is, shared early environmental factors and/or genetics. Sensitivity analyses were performed by excluding twins who did not reach the age of marriage (ie, 18 years old, n = 1620 [4.3%]) in 1990 (n = 36,247) (See Supplementary Table 3–6, http://links.lww.com/JOM/B331 and Fig. 1, http://links.lww.com/JOM/B332). However, only marginal differences in the results were observed. All analyses were conducted by using SAS Statistical Software, version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Table 1 presents descriptive statistics for family-related life events, sociodemographic factors, and history of inpatient care at the baseline in 1990–1993 and LMM during the follow-up from 1994 to 2016. Among 37,867 twins, 1352 individuals were unemployed (3.6), 4382 had SA (11.6%), and 3037 were granted DP (8.0%) during the follow-up. Among discordant twin pairs, a larger proportion of women (54.3% vs 49.1%), those who had a history of somatic diagnosis (57.5% vs 39.4%) and DP (7.8% vs 9.1%) during follow-up time, were found in twins with

TABLE 3. Odds Ratios With 95% CIs for Changed Family Life Compared With Stable Family Life in Relation to SA/DP Trajectory Groups Among Whole Sample and Within Discordant Twin Pairs

	Whole Sample[a]				
	Low constant (n = 5,557)	**Low increasing (n = 1,246)**	**Middle increasing (n = 868)**	**Middle fluctuant (n = 1,127)**	**High constant (n = 834)**
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.72 (0.57–0.91)**	0.88 (0.57–1.35)	**0.46 (0.23–0.90)**	**0.49 (0.28–0.87)**	**0.35 (0.16–0.76)**
From married[b] without children to single[c] with/without children	**1.82 (1.09–3.03)**	1.16 (0.36–3.75)	2.44 (0.93–6.36)	1.16 (0.35–3.83)	1.40 (0.44–4.48)
From married[b] with children to single[c] without children	**1.54 (1.21–1.96)**	1.18 (0.73–1.92)	**1.89 (1.20–2.96)**	0.96 (0.55–1.68)	0.55 (0.27–1.12)
From married[b] with children to single[c] with children	**1.46 (1.20–1.77)**	1.28 (0.89–1.83)	1.30 (0.87–1.95)	**2.23 (1.67–2.97)**	0.97 (0.60–1.56)
From single[c] without children to married[b] without children	1.03 (0.83–1.28)	0.75 (0.44–1.26)	0.70 (0.36–1.37)	0.65 (0.35–1.19)	1.03 (0.56–1.88)
From single[c] without children to married[b] with children	**0.89 (0.80–0.99)**	0.87 (0.70–1.09)	**0.72 (0.53–0.97)**	**0.76 (0.59–0.98)**	**0.19 (0.11–0.35)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	1.28 (1.00–1.65)	1.15 (0.72–1.86)	**1.88 (1.21–2.92)**	1.24 (0.79–1.96)	0.51 (0.24–1.07)
From single[c] with children to married[b] with/without children	1.00 (0.73–1.37)	1.42 (0.87–2.31)	1.49 (0.88–2.55)	1.56 (0.98–2.48)	0.82 (0.39–1.72)
	Discordant twin pairs				
	Low constant (n = 1,533)	**Low increasing (n = 326)**	**Middle increasing (n = 232)**	**Middle fluctuant (n = 318)**	**High constant (n = 184)**
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.75 (0.57–0.99)**	0.91 (0.55–1.51)	**0.45 (0.21–0.99)**	0.57 (0.31–1.05)	**0.28 (0.11–0.73)**
From married[b] without children to single[c] with/without children	1.22 (0.62–2.40)	1.53 (0.46–5.03)	2.79 (0.94–8.26)	1.11 (0.26–4.73)	1.77 (0.46–6.86)
From married[b] with children to single[c] without children	**1.53 (1.16–2.02)**	1.06 (0.58–1.92)	**1.94 (1.13–3.31)**	1.14 (0.63–2.10)	0.48 (0.21–1.12)
From married[b] with children to single[c] with children	**1.35 (1.06–1.71)**	1.23 (0.78–1.94)	0.83 (0.47–1.46)	**2.02 (1.41–2.90)**	0.83 (0.47–1.49)
From single[c] without children to married[b] without children	0.92 (0.70–1.21)	0.78 (0.44–1.39)	0.62 (0.27–1.42)	0.57 (0.28–1.18)	1.12 (0.56–2.24)
From single[c] without children to married[b] with children	0.87 (0.75–1.01)	0.87 (0.64–1.18)	0.69 (0.47–1.02)	**0.57 (0.41–0.80)**	**0.20 (0.10–0.39)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	0.98 (0.72–1.34)	1.31 (0.77–2.25)	1.59 (0.92–2.75)	0.88 (0.49–1.57)	0.46 (0.19–1.09)
From single[c] with children to married[b] with/without children	0.95 (0.65–1.38)	1.31 (0.69–2.47)	1.10 (0.53–2.26)	1.49 (0.86–2.58)	1.01 (0.44–2.30)

Significant results are marked in bold.

[a]Sex, age, education, area of residence, and history of mental and somatic diagnosis at baseline were adjusted in the model with the whole sample.

[b]Married includes living with partner; cohabitant.

[c]Single includes divorced, separated or widowed.

change in family life compared with their cotwins with stable family life (Table 1).

Trajectory Analyses of LMM

We identified six groups of trajectories of annual unemployment and SA/DP months as well as of a combined measure of LMM months for the whole sample during 1994–2016 (Fig. 1).

For the whole sample, most individuals (50.3%, 73.0%, and 56.7%) belonged to either "no unemployment," "no SA/DP," or "no labor market marginalization" group with constantly no unemployment, SA/DP, or LMM month during 1994–2016. We also observed that individuals had apparently lower unemployment months compared with SA/DP months over time. There were 2.5% of individuals who belonged to "middle fluctuating" group that showed approximately 3 months of unemployment. For SA/DP and LMM trajectories, approximately 2% of individuals had 12 months of SA/DP or LMM between 1999 and 2015 (Fig. 1).

Association between Family-Related Life Events and LMM Trajectories

Table 2 presents adjusted odds ratios (ORs) for change in family life compared with stable family life in relation to unemployment trajectory groups among the whole sample. Increased likelihood of belonging to "no unemployment" trajectory group was observed among individuals who remained in the marriage but changed the status of having children and among those who changed from single without children to married with children compared with individuals with stable family life after controlling for sociodemographic and a history of mental and somatic diagnosis in the model. On the contrary, individuals changed from married to single regardless of status of having children and individuals changed from single with children to married with/without children showed a higher likelihood of belonging to one of the trajectory groups with some months of unemployment compared with individuals with stable family life (range of ORs, 1.31–4.44) (Table 2).

Similar results were observed for the associations between family-related life events and SA/DP and the combined measure of LMM trajectories in the whole sample. Married individuals who changed from living without children to living with children, or from living with children to without as well as individuals who changed from single without children to married with children were less likely to have any month of SA/DP or LMM compared with individuals with stable family life. Individuals who changed from married to single status tended to have a higher level of SA/DP and LMM during 1994–2016 than those with stable family life (Tables 3,4).

In addition, the analysis with discordant twin pairs showed somewhat lower ORs in relation to all outcomes in Tables 2 to 4. We found no systematic effect of familial factors, but they cannot be ruled out because the point estimates were attenuated for some family-related life events.

DISCUSSION

By applying a life course approach and using a large population-based cohort of Swedish twins (N = 37,867) aged between 20 and

TABLE 4. Odds Ratios With 95% CIs for Changed Family Life Compared With Stable Family Life in Relation to LMM Trajectory Groups Among Whole Sample and Within Discordant Twin Pairs

	Whole Sample[a]				
	Low increasing (n = 4,151)	Middle increasing (n = 978)	Middle decreasing (n = 7,423)	Middle fluctuant (n = 2,622)	High constant (n = 902)
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.66 (0.51–0.87)**	**0.38 (0.19–0.75)**	**0.62 (0.49–0.79)**	**0.64 (0.45–0.91)**	**0.38 (0.19–0.79)**
From married[b] without children to single[c] with/without children	1.56 (0.85–2.85)	2.29 (0.87–6.01)	1.03 (0.56–1.89)	**2.32 (1.19–4.53)**	1.44 (0.45–4.57)
From married[b] with children to single[c] without children	**1.34 (1.01–1.77)**	**1.77 (1.12–2.81)**	**1.38 (1.08–1.77)**	**1.44 (1.03–2.02)**	0.77 (0.41–1.44)
From married[b] with children to single[c] with children	1.11 (0.85–1.45)	**1.91 (1.34–2.73)**	**1.71 (1.38–2.10)**	**2.51 (1.98–3.17)**	1.18 (0.74–1.88)
From single[c] without children to married[b] without children	0.96 (0.75–1.23)	0.82 (0.47–1.45)	0.84 (0.68–1.03)	**0.43 (0.27–0.69)**	0.94 (0.52–1.68)
From single[c] without children to married[b] with children	**0.82 (0.72–0.94)**	**0.70 (0.53–0.93)**	**0.87 (0.78–0.96)**	**0.72 (0.61–0.85)**	**0.23 (0.14–0.38)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	1.16 (0.82–1.62)	**2.40 (1.58–3.67)**	**1.63 (1.25–2.12)**	**2.01 (1.45–2.78)**	0.77 (0.39–1.52)
From single[c] with children to married[b] with/without children	0.78 (0.51–1.19)	1.46 (0.85–2.51)	1.22 (0.89–1.69)	**1.90 (1.34–2.71)**	1.26 (0.67–2.38)
	Discordant twin pairs				
	Low increasing (n = 1,062)	**Middle increasing (n = 261)**	**Middle decreasing (n = 1,798)**	**Middle fluctuant (n = 736)**	**High constant (n = 209)**
Family-related life events (1990–1993)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
From married[b] without children to married[b] with children/from married[b] with children to married[b] without children	**0.71 (0.52–0.97)**	**0.32 (0.14–0.74)**	**0.67 (0.51–0.88)**	0.67 (0.45–1.00)	**0.34 (0.15–0.78)**
From married[b] without children to single[c] with/without children	1.66 (0.83–3.31)	2.54 (0.86–7.54)	0.83 (0.37–1.81)	1.82 (0.78–4.24)	1.74 (0.45–6.74)
From married[b] with children to single[c] without children	1.35 (0.97–1.88)	1.65 (0.95–2.88)	1.31 (0.98–1.75)	1.40 (0.96–2.07)	0.69 (0.33–1.44)
From married[b] with children to single[c] with children	1.18 (0.87–1.60)	1.32 (0.81–2.15)	**1.43 (1.11–1.84)**	**2.06 (1.54–2.77)**	0.92 (0.52–1.62)
From single[c] without children to married[b] without children	1.02 (0.76–1.36)	0.70 (0.35–1.41)	**0.75 (0.58–0.98)**	**0.28 (0.15–0.52)**	1.00 (0.51–1.94)
From single[c] without children to married[b] with children	0.93 (0.78–1.11)	**0.64 (0.44–0.92)**	**0.87 (0.75–0.99)**	**0.59 (0.47–0.73)**	**0.24 (0.13–0.44)**
From single[c] without children to single[c] with children/from single[c] with children to single[c] without children	1.17 (0.79–1.73)	**2.20 (1.32–3.69)**	**1.49 (1.09–2.03)**	**1.52 (1.02–2.26)**	0.55 (0.23–1.30)
From single[c] with children to married[b] with/without children	0.77 (0.46–1.26)	0.82 (0.37–1.84)	1.11 (0.76–1.63)	1.55 (1.00–2.40)	1.50 (0.75–3.01)

Significant results are marked in bold.

[a]Sex, age, education, area of residence, and history of mental and somatic diagnosis at baseline were adjusted in the model with the whole sample.

[b]Married includes living with partner; cohabitant.

[c]Single includes divorced, separated, or widowed.

40 years, we identified six trajectories of LMM including unemployment, SA/DP, and a combined measure during 1994–2016. This result is in accordance with previous studies which examined LMM trajectories with specific patient group, suggesting a heterogeneity in LMM.[1,40] In this study, majority of the individuals had no or considerably low levels of unemployment, SA/DP, and combined measure of LMM over time. In line with the health selection hypothesis, individuals with optimal health conditions are more likely to stay in employment, whereas individuals with poorer health are more likely to be or remain unemployed, receive sick pay, or DPs.[41] Hence, our finding suggests that our study population of relatively young age was in good health. In contrast, there were roughly 2% of individuals belonged to "high constant" group with approximately 12 months of SA/DP or LMM annually over time. It is possible that this group consisted of a large proportion of individuals with long-term SA or DP. In addition, we observed a distinctly lower level of unemployment compared with SA/DP, which is supported by another study.[1] It seems that SA/DP is the major component of LMM. Moreover, we could not investigate socioeconomic profiles in relation to the trajectory groups and further study, with a focus on those factors, might gain more knowledge on the heterogeneity of LMM.

In the analysis of family-related life events and LMM trajectories, we found that individuals who were stably married with changed status of having children and who changed from single living without children to married living with children had a lower risk of having unemployment, SA/DP, and combined LMM months over time than individuals with stable family life. In general, individuals fulfill emotional, social, and material needs often by involving in different life events consisting of spouses, children, siblings, and other confidants. Previous studies have reported that a positive change in life is associated with decreased risk of DP and cancer.[28] Our findings show that the benefits of maintaining in the relationship and forming a family with children are even greater than remaining in stable family life without any changes (ie, neither in marital status and nor in having children).

Contrary to the positive changes, individuals who experienced a divorce had a higher risk of having some months of unemployment, SA/DP, and the combined LMM during the follow-up period. Several earlier studies have shown the negative consequences of divorce on health and labor market outcomes.[15–17,19,20] This may be due to increased stresses and strains that accompany a divorce, such as increased care-giving and financial difficulties. Particularly for single parents, they are more likely to experience psychological distress, financial hardship as well as lower levels of social support, which might cause them to lose sustainable ability to work.[18] Another possible explanation for the findings is the unhealthy lifestyle. For example, the association between heavy use of alcohol and a higher risk of divorce has been reported,[42] which is potentially one of the reasons for subsequent LMM. The effects stemming from familial factors were not apparent in the present study; however, because the risk estimates were reduced for some family-related life events, the influence from familial factors cannot be ignored.

Strengths and Limitations

The main strengths of this study include the use of a sizeable population-based sample of twins ($N = 37{,}867$), which provided satisfactory statistical power for the analyses. The other strengths include the long follow-up period (23 years), a prospective cohort design, and the use of nationwide register data of high quality,[37] which minimizes the risk of loss to follow-up and recall or reporting biases. In addition, we could include discordant twin pairs in the analyses to account for the influence stemming from familial factors. However, analyses with MZ and DZ twin pairs were not possible to perform because there was not enough statistical power to stratify by zygosity. In this study, we were also able to include several important covariates, but there might be other potential factors that are associated with the outcomes as well, such as occupational groups, LMM at baseline, or unhealthy lifestyle, that should be addressed in further studies.

Regarding limitations, information on sick-leave spells less than 14 days was not accessible among employed individuals, which means that for employed individuals, the number of SA days contributing to the combined number of SA/DP days might be underestimated. Another limitation is related to the life course perspective because we assessed family-related life events only retrospectively in 1990–1993. However, our measure for LMM was prospective from 1994 to 2016 reflecting the life course approach. Future studies should explore the concurrent changes in family-related life events and LMM using prospective designs with reasonable follow-up time. In addition, the findings from the study may not be generalizable to individuals with short-term SA spells (<14 days). Still, the findings in this study can be generalized to individuals living in countries with comparable economic and labor market conditions and health care and social insurance systems. Moreover, family-related life events occurred in one twin may have spillover effects on the other twin. However, the twin design ensures that the association between family-related life events and LMM trajectories is not driven by familiar factors.

CONCLUSIONS

Most of the individuals had no or low levels of LMM during 1994–2016. Staying or getting married and having children were associated with a lower risk of LMM whereas divorce was a risk factor for LMM.

ACKNOWLEDGMENTS

The authors thank the Swedish Twin Registry for access to data.

REFERENCES

1. Helgesson M, Tinghög P, Wang M, Rahman S, Saboonchi F, Mittendorfer-Rutz E. Trajectories of work disability and unemployment among young adults with common mental disorders. *BMC Public Health* 2018;18:1228.
2. Thorsen SV, Friborg C, Lundstrom B, et al. *Sickness Absence in the Nordic Countries*. Copenhagen: Nordic Social Statistical Committee; 2015.
3. Helgesson M, Tinghog P, Niederkrotenthaler T, Saboonchi F, Mittendorfer-Rutz E. Labour-market marginalisation after mental disorders among young natives and immigrants living in Sweden. *BMC Public Health* 2017;17:593.
4. OECD. *Sickness, disability and work: breaking the barriers: a synthesis of findings across OECD countries*. Paris: OECD Publishing; 2010.
5. Gjesdal S, Bratberg E. Diagnosis and duration of sickness absence as predictors for disability pension: results fFrom a three-year, multi-register based and prospective study. *Scand J Public Health* 2003;31:246–254.
6. Alexanderson K, Kivimäki M, Ferrie JE, et al. Diagnosis-specific sick leave as a long-term predictor of disability pension: a 13-year follow-up of the GAZEL cohort study. *J Epidemiol Community Health* 2012;66:155–159.
7. Karlsson NE, Carstensen JM, Gjesdal S, Alexanderson KA. Risk factors for disability pension in a population-based cohort of men and women on long-term sick leave in Sweden. *Eur J Public Health* 2008;18:224–231.
8. Rahman SG, Alexanderson K, Jokinen J, Mittendorfer-Rutz E. Disability pension due to common mental disorders and subsequent suicidal behaviour: a population-based prospective cohort study. *BMJ Open* 2016;6:e010152.
9. Stauder J. Unemployment, unemployment duration, and health: selection or causation? *Eur J Health Econ* 2019;20:59–73.
10. Allebeck P, Mastekaasa A. Swedish council on technology assessment in health care (SBU). Chapter 5. Risk factors for sick leave—general studies. *Scand J Public Health Suppl* 2004;63(suppl 63):49–108.
11. Carlsen K, Dalton SO, Diderichsen F, Johansen C. Risk for unemployment of cancer survivors: a Danish cohort study. *Eur J Cancer* 2008;44:1866–1874.
12. Jørgensen MB, Thygesen LC, Becker U, Tolstrup JS. Alcohol consumption and risk of unemployment, sickness absence and disability pension in Denmark: a prospective cohort study. *Addiction* 2017;112:1754–1764.
13. Ropponen A, Wang M, Farrants K, Narusyte J, Svedberg P. Psychosocial working conditions and subsequent sickness absence-effects of pain and common mental disorders in a population-based Swedish twin sample. *J Occup Environ Med* 2022;64:451–457.
14. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *Int J Epidemiol* 2002;31:285–293.
15. Grundy EM, Tomassini C. Marital history, health and mortality among older men and women in England and Wales. *BMC Public Health* 2010;10:554.

16. Silventoinen K, Korhonen K, Martikainen P. Changing associations of coronary heart disease incidence with current partnership status and marital history over three decades. *SSM Popul Health* 2022;18:101080.
17. Honjo K, Iso H, Ikeda A, Inoue M, Sawada N, Tsugane S. Marital transition and risk of stroke: how living arrangement and employment status modify associations. *Stroke* 2016;47:991–998.
18. Cairney J, Thorpe C, Rietschlin J, Avison WR. 12-month prevalence of depression Among single and married mothers in the 1994 National Population Health Survey. *Can J Public Health* 1999;90:320–324.
19. Kuroishi M, Nagata T, Hino A, et al. Prospective cohort study of sociodemographic and work-related factors and subsequent unemployment under COVID-19 pandemic. *Int J Environ Res Public Health* 2022;19.
20. Bröckel M, Andreß HJ. The economic consequences of divorce in Germany: what has changed since the turn of the millennium? *Comp Popul Stud* 2015;40.
21. Franco A, Winqvist K. Women and men reconciling work and family life. In: *Statistics in Focus, Population and Social Conditions. Report No 9*. Luxembourg: Eurostat; 2002.
22. Bratberg E, Dahl SA, Erling RA. "The double burden": do combinations of career and family obligations increase sickness absence among women? *Eur Sociol Rev* 2002;18:233–249.
23. Voss M, Josephson M, Stark S, et al. The influence of household work and of having children on sickness absence among publicly employed women in Sweden. *Scand J Public Health* 2008;36:564–572.
24. Floderus B, Hagman M, Aronsson G, Marklund S, Wikman A. Medically certified sickness absence with insurance benefits in women with and without children. *Eur J Public Health* 2012;22:85–92.
25. Voss M, Floderus B, Diderichsen F. How do job characteristics, family situation, domestic work, and lifestyle factors relate to sickness absence? A study based on Sweden post. *J Occup Environ Med* 2004;46:1134–1143.
26. Björkenstam E, Narusyte J, Alexanderson K, Ropponen A, Kjeldgård L, Svedberg P. Associations between childbirth, hospitalization and disability pension: a cohort study of female twins. *PloS One* 2014;9:e101566.
27. Wang M, László KD, Svedberg P, Nylén L, Alexanderson K. Childbirth, morbidity, sickness absence and disability pension: a population-based longitudinal cohort study in Sweden. *BMJ Open* 2020;10:e037726.
28. Kärkkäinen S, Silventoinen K, Svedberg P, Ropponen A. Life events as predictors for disability pension due to musculoskeletal diagnoses: a cohort study of Finnish twins. *Int Arch Occup Environ Health* 2020;93:469–478.
29. Kendler KS. Twin studies of psychiatric illness: an update. *Arch Gen Psychiatry* 2001;58:1005–1014.
30. Carlin JB, Gurrin LC, Sterne JA, Morley R, Dwyer T. Regression models for twin studies: a critical review. *Int J Epidemiol* 2005;34:1089–1099.
31. Røysamb E, Tambs K. The beauty, logic and limitations of twin studies. *Norsk Epidemiologi* 2016;26(1–2):35–46.
32. Narusyte J, Ropponen A, Silventoinen K, et al. Genetic liability to disability pension in women and men: a prospective population-based twin study. *PloS One* 2011;6:e23143.
33. Kendler KS, Baker JH. Genetic influences on measures of the environment: a systematic review. *Psychol Med* 2007;37:615–626.
34. Svedberg P, Ropponen A, Alexanderson K, Lichtenstein P, Narusyte J. Genetic susceptibility to sickness absence is similar among women and men: findings From a Swedish twin cohort. *Twin Res Hum Genet* 2012;15:642–648.
35. Magnusson PK, Almqvist C, Rahman I, et al. The Swedish twin registry: establishment of a biobank and other recent developments. *Twin Res Hum Genet* 2013;16:317–329.
36. Ludvigsson JF, Svedberg P, Olen O, Bruze G, Neovius M. The Longitudinal Integrated Database for Health Insurance and Labour Market Studies (LISA) and its use in medical research. *Eur J Epidemiol* 2019;34:423–437.
37. Ludvigsson JF, Andersson E, Ekbom A, et al. External review and validation of the Swedish national inpatient register. *BMC Public Health* 2011;11:450.
38. Swedish Social Insurance Agency. Social insurance in figures. 2022.
39. Jones B, Nagin D, Roeder K. A SAS procedure based on mixture models for estimating developmental trajectories. *Sociol Methods Res* 2001;29:374–393.
40. Wang M, Vaez M, Dorner TE, et al. Trajectories and characteristics of work disability before and after acute myocardial infarction. *Heart* 2018;104:340–348.
41. Adler DA, McLaughlin TJ, Rogers WH, Chang H, Lapitsky L, Lerner D. Job performance deficits due to depression. *Am J Psychiatry* 2006;163:1569–1576.
42. Collins RL, Ellickson PL, Klein DJ. The role of substance use in young adult divorce. *Addiction* 2007;102:786–794.

